

## OBSERVATIONS AT HABANA, CUBA.

Through the kindness of the Director of the Belen Observatory, Rev. L. Gangoiti, the observations made at that station at 1 p. m., Greenwich mean time, or 8 a. m., seventy-fifth meridian time, are communicated to the Weather Bureau promptly by mail, and are herewith published for general use. The position of the observatory is N. 23° 8' 14", W. 76° 9' 42", from San Fernando, or 69° 57' west from Greenwich; altitude of the barometer 24.347 meters (79.7 feet); the barometric readings have been reduced to sea level and converted into English measures by the Director. The correction for local gravity has not been applied; so far as it concerns latitude, the correction for 30 inches of mercury is —0.054 inch. The clouds are observed with much minuteness; two kinds are frequently recorded under the general headings "upper" or "lower"; in these cases the two kinds are printed in the accompanying table in the same column but separated by a semicolon; their respective directions are also separated by a semicolon. The rainfall is given for the twenty-four hours ending with 1 p. m., Greenwich time. Most of these observations seem to be read off from the records of the Secchi meteorograph, but the directions of the clouds have apparently been observed accurately by the use of the reflecting nephoscope. The kinds of clouds are indicated in the accompanying table, by the same letters as those used in the original manuscript, which undoubtedly agree with the following paragraph quoted from the annual volume published by the same observatory:

The clouds are classified as upper and lower; among the upper clouds the following are included, arranging them in the order of decreasing altitude from above downward, viz: *c*, cirrus; *ck*, cirro-cumulus; *cs*, cirro-stratus; *ka*, alto-cumulus. Among the lower clouds the following are included: *kb*, lower cumulus; *sk*, strato-cumulus; *s*, stratus, and *n*, nimbus. The false cirrus is not included; the lower cirro-cumulus is included with the alto-cumulus; the cumulo-nimbus is included with the strato-cumulus.

## Meteorological data, Habana, Cuba, March, 1898.

Date.	Barometer reduced to sea level.	Temperature of air.	Relative humidity.	Wind.		Upper clouds.			Lower clouds.			Total rainfall.
				Direction.	Velocity.	Kind.	Amount.	Direction.	Kind.	Amount.	Direction.	
1....	30.05	63.9	54	nne.	10	k	2	nne.		0		0.06
2....	30.08	61.2	83	ne.	1	cs	F.	wsu.		0		0.00
3....	29.93	65.1	91	wsu.	15		0		n	10		0.76
4....	30.04	73.9	76	wnw.	7	k	3	sw.	sk; s	7	wnw.	0.12
5....	30.21	68.2	67	n.	11	c; cs; k	1	aw; n.	k; sk	5	nne.	0.02
6....	30.19	63.9	88		0	cs	4	wsu.	k; sk	5	ene; —	0.08
7....	30.11	65.3	83		0	k	5	w.	sk; s	2	ene; nne.	0.01
8....	30.01	64.4	84	ne.	1	cs; k	5	—; w.	sk	F.		0.00
9....	30.00	66.7	87	e.	2	k	2	ne.	sk	1		0.03
10....	30.06	64.6	82		0	k	F.	nw.	k; sk	1	ene; w.	0.00
11....	30.05	64.4	84	ne.	1		0		k; sk	F.	ene; —	0.00
12....	30.08	71.4	77	e.	12		0		sk	F.		0.00
13....	30.07	68.0	72	ene.	1	{cs; } {k }	2	{nw; } {ese. }	k	F.		0.00
14....	30.09	67.5	74	ese.	8	k	7	ese.		0		0.00
15....	30.13	67.1	81	e.	5		0			0		0.00
16....	30.16	68.5	79	e.	4		0		k	F.		0.00
17....	30.19	68.7	83	ne.	0	k	F.	ene.	sk	F.		0.00
18....	30.20	69.8	75	ene.	2		0		k; sk	F.	ene; —	0.00
19....	30.20	69.1	73	e.	6	cs	F.		k; sk	F.	—; —	0.00
20....	30.21	70.5	70	e.	4	k	4	e.		0		0.00
21....	30.19	69.8	80	ene.	0	k	F.		sk	F.		0.00
22....	30.16	72.1	75	ene.	5		0			0		0.00
23....	30.14	72.5	73	ese.	8	k	F.	ese.		0		0.00
24....	30.14	70.3	89	ene.	5		0			0		0.00
25....	30.18	72.7	76	e.	10		0			0		0.00
26....	30.22	71.1	77	e.	7		0		k	F.	ene.	0.00
27....	30.18	70.3	77	e.	1		0		k; sk	1	ene.	0.00
28....	30.15	73.4	72	ene.	8		0		k; sk	1	ese; —	0.00
29....	30.13	72.0	68	e.	12	cs; k	1	nw; —	sk	F.		0.00
30....	30.13	68.9	71	e.	1	c; cs	1	wnw.	sk	F.		0.00
31....	30.11	68.5	77	ese.	1		0			0		0.00
Sum.												1.08

## OBSERVATIONS AT HONOLULU, REPUBLIC OF HAWAII.

Through the kind cooperation of Mr. Curtis J. Lyons, Meteorologist to the Government Survey, a copy of the daily record at Honolulu is communicated to the Weather Bureau

in advance of its official publication, and is herewith printed, as a special contribution, for the convenience of those who are studying the relations of the storms and weather of the United States to those of adjacent countries, with a view to long-range, seasonal predictions.

## Meteorological observations at Honolulu, Republic of Hawaii.

The station is at 21° 18' N., 157° 50' W.; altitude 50 feet. Pressure is corrected for temperature and reduced to sea level, but the gravity correction, —0.06, is still to be applied. The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 10. Two directions of wind, or values of wind force, connected by a dash, indicate change from one to the other. The rainfall for twenty-four hours is given as measured at 6 a. m. on the respective dates.

MARCH, 1898.

March, 1898.	Pressure at sea level.			Temperature.				Relative humidity.			Wind.		Cloudiness.	Rain measured at 6 a. m.
	6 a. m.	3 p. m.	9 p. m.	6 a. m.	3 p. m.	9 p. m.	Maximum.	Minimum.	7 a. m.	2 p. m.	9 p. m.	Direction.	Force.	
1....	Ins.	29.93	29.96	60	72	62	73	60	84	57	84	n-w.	1	1-3
2....	30.03	29.97	30.13	60	74	68	74	60	79	30	57	n.	1-5	6-0
3....	30.20	30.13	30.22	65	71	68	73	65	81	40	60	nne.	6	3
4....	30.25	30.15	30.23	67	68	67	71	65	71	71	67	ene.	4	7
5....	30.17	30.10	30.15	66	71	68	73	64	71	60	67	ene.	3-5	6
6....	30.08	30.02	30.10	64	72	69	74	62	80	63	70	ne.	4	7
7....	30.08	30.04	30.12	64	73	69	74	61	76	59	72	ene.	4	7
8....	30.09	30.05	30.12	66	72	70	74	64	67	69	72	ene.	4	7
9....	30.08	30.04	30.11	66	70	68	72	63	72	78	78	ne.	4	5
10....	30.08	30.04	30.10	66	69	69	74	64	73	78	78	ene.	4	5
11....	30.07	30.04	30.05	67	73	71	74	65	76	69	69	ene.	4-5	8-10
12....	30.04	30.00	30.01	69	68	71	71	66	82	78	77	n-wsw.	1-6	10
13....	29.93	29.86	29.96	68	77	72	78	65	95	70	82	n-wsw.	1-6	10
14....	29.93	29.90	29.97	67	74	70	74	66	97	80	80	sw.	1-4	10
15....	29.93	29.90	30.00	70	76	70	77	69	95	78	93	sw.	1-4	10
16....	29.94	29.89	29.96	70	76	73	77	67	90	83	93	se-s.	2-3	10-5
17....	29.94	29.90	30.00	71	74	72	76	70	90	90	90	sw.	2	8
18....	29.96	29.98	30.08	68	76	69	77	67	93	78	89	sw.	3-1	6-10
19....	30.06	29.99	30.07	67	77	69	77	67	98	74	97	sw.	1	6-10
20....	30.07	30.01	30.11	67	72	68	75	67	93	80	97	ne.	0-1	10
21....	30.07	30.04	30.09	67	73	70	75	65	93	69	79	ne.	0-1	10
22....	30.07	30.03	30.10	65	73	71	75	63	95	77	79	ne.	0-1	10
23....	30.05	30.00	30.06	69	73	71	74	63	89	74	77	ne.	3	8
24....	30.01	29.96	29.99	69	65	67	74	62	77	90	85	nw-ne.	0-8	10
25....	29.96	29.93	30.00	69	75	70	75	65	81	70	77	ne.	3	3-7
26....	29.99	29.95	30.03	69	74	70	77	69	82	74	85	ne-se.	3-2	5-10
27....	30.04	30.00	30.00	70	75	72	77	67	85	74	82	ene.	3	10-5
28....	30.09	30.06	30.11	70	73	72	75	70	93	72	71	ene.	5-6	10-8
29....	30.10	30.05	30.18	69	74	71	75	67	74	64	68	ne.	5	7-10
30....	30.13	30.06	30.17	69	71	71	73	69	68	71	68	ne.	5	10-6
31....	30.15	30.09	30.19	68	72	70	74	69	69	68	64	ne.	6	4-6
30.05	30.00	30.08	30.11	73.0	69.5	74.6	65.2	82.5	70.3	77.5				12.70

Mean temperature: 6+2+9+8 is 69.9°; extreme temperatures, 78° and 60°.

## CUMULUS CLOUDS OVER A FIRE.

By R. DE C. WARD (dated April 1, 1898).

An interesting observation of the formation of small cumulus clouds over a fire was made by the writer on October 29 last, at the southern station of the Harvard College Observatory, at Arequipa, Peru (altitude 8,050 feet above sea level). At about 3:45 p. m. on that day there was observed behind the western flank of Mount Charchani (20,000 feet above sea level), and about 15 miles or so away, a column of smoke rising from a considerable fire of brushwood behind the mountain. The altitude above sea level of the fire was about 14,000 feet, judging by its relation to the height of the mountain. As the writer was looking at the smoke, which was rising to a considerable height, he noticed the formation of a small cumulus cloud directly over the smoke column, and approximately at a height of 17,000 or 18,000 feet above sea level, or 3,000 to 4,000 feet above the fire. The sky at this time was clear, except a trace of cirrus in the west and southwest. The wind at Arequipa was west about 15 miles an hour.

The cloud was only a fragment, and disappeared very soon, drifting to the southeast. It was succeeded by another small cumulus, which again disappeared within five minutes. The smoke column was ascending apparently near vertically, but its top was blown somewhat toward the southeast. Success-

sive cloudlets, rather fracto-cumulus than true cumulus, formed over the smoke, none of them lasting more than three minutes, and most of them only one minute. Eight distinct cloudlets were seen thus to form and dissolve within the space of half an hour, at the end of which time the smoke had disappeared.

At Arequipa the wind, as stated above, was west 15 miles. Where the smoke was (14,000 feet) it was nearly calm. At the level of the cirro-cumulus clouds there was a strong current from west-northwest. Although the smoke column was small, evidently the conditions were favorable for cloud formation. The whole thing, however, was on a miniature scale.

Cumulus clouds over fires were described by Espy in his Fourth Meteorological Report. A recent case was noted by the writer in *Science*, January 8, 1897, pp. 60-61.

#### THUNDERSTORMS IN NEW BRUNSWICK, 1897.

By SAMUEL W. KAIN, Librarian of the Natural History Society of New Brunswick (dated St. John, April 4, 1898).

During the year 1897 I made some observations on the thunderstorms which occurred in this Province and perhaps the results may be of interest.

Before examining the record, however, it may be well to say a few words in a general way about thunderstorms.

*Cause.*—Russell says "thunderstorms are due to a rapid decrease of temperature with ascent in the air, and the presence of a great deal of moisture in the lower air."

The passage of a thunderstorm is so well known that it is hardly necessary for me to give a description.

In St. John the coming of a thunderstorm is preceded by cumulo-nimbus clouds appearing from the northwest during the afternoon or early in the evening. During 1897 thunder was recorded at St. John on the following dates:

Date.	A. M. or P. M.	Remarks.	Date.	A. M. or P. M.	Remarks.
May 21...	p. m.	Rainfall, 0.62.	Aug. 6...	p. m.	Distant.
June 16...	p. m.		Aug. 8...	p. m.	Slight.
June 18...	p. m.	Rainfall, 0.28.	Aug. 9...	p. m.	Distant.
June 20...	a. m.	Rain all day.	Aug. 15...	p. m.	Lightning; no thunder.
June 28...	p. m.		Aug. 17...	p. m.	Rainfall, 0.36.
July 9...	p. m.	Distant.	Sept. 9...	p. m.	Lightning; no thunder.
July 30...	a. m.	Rainfall, 0.57.	Sept. 10...	p. m.	Rainfall, 0.48.
Aug. 1...	p. m.		Sept. 21...	a. m.	
Aug. 4...	a. m.	Rainfall, 0.510.			

Of these storms 13 occurred in the afternoon and 4 in the morning. Two storms were reported from the Bay of Fundy, both at night. The storm of August 1 was the heaviest observed at St. John during the year.

*Barometer.*—The barometer falls on the approach of a storm. The highest barometer immediately before a storm was 30.06, on September 9; the lowest, 29.526, on June 28. On the arrival of the wind squall the barometer rises. On September 21 it rose from 29.6 to 29.64, or 0.04; on June 28 it rose from 29.526 to 29.586, or 0.06, and on June 16 it rose from 29.65 to 29.68, or 0.03. After the wind dies out the barometer falls and then rises gradually.

*Temperature.*—The temperature before these storms was in no case high. Prof. W. M. Davis, in his excellent book on meteorology, says that "the temperature preceding the storm is, as a rule, oppressively high." The highest temperature recorded just before a thunderstorm at St. John in 1897 was 70° F., on August 1. This was the heaviest storm of the year. The lowest temperature was 47° F., on May 1. The temperature preceding the storm of January 23, 1898, was only 18°.

When the wind squall arrives with rain the temperature falls slightly. During the storm of August 1, the thermometer fell from 70° to 67.3°, or 2.7°. In warmer climates the fall is sometimes from 10° to 20°.

*Wind.*—The wind before storms at St. John has, in nearly all cases, been shifting from southeast, southwest, and south, and then blows steadily from the northwest on arrival of the storm. All the storms came from the northwest except the great storm of August 1, which was from the northeast. It was a dead calm when this storm broke on the city.

The storms of August 8 and 15 were noticeable for the fact that while the heavy thunder clouds were rapidly advancing from the northwest the wind was blowing steadily from the southeast.

*Rainfall.*—The rainfall from some of these storms was heavy. On May 21 it was 0.62, on August 4 it was 0.510, on September 21 it was 0.48, and on August 1 it was 0.570.<sup>1</sup>

During the storm of June 18 the heaviest clap of thunder was followed by hail. During the storm of August 6 hail fell at Loch Lomond, and Mr. C. H. Jackson tells me that the hailstones were large and rebounded as high as four feet from the platform in front of the Log Cabin Fishing Club. At Tower Hill and Oak Bay the hailstones did some damage to the crops.

No hail fell in St. John in the storm of August 9, but at Upper St. Davids, Charlotte County, large hailstones fell, breaking glass in the windows of a church, and on the same day at Meadows, Pomerey Ridge, Scotch Ridge, Tower Hill, Baillie, and Moores Mills, the hail did considerable damage to the crops. In some parts of Albert County on the same day the crops suffered considerable damage from hail.

*Cloudburst.*—The heavy downpour of rain known as a cloudburst is supposed to occur only in the distant west, but there can be no doubt that we had an exhibition of this unwelcome phenomenon in the great storm of August 1. It occurred near the premises of Mr. Edward L. Price, about 6 miles southwest of Sussex Station, about 3 o'clock in the afternoon. A correspondent tells me that the storm broke over the settlement with great violence. The lightning was intensely vivid, the thunder terrific, and the rain was indeed a cloudburst. The area affected was small, but great damage was done. The soil was scooped from the hillside, and a great scar, which can be seen at a considerable distance, remains as a lasting memorial of the visitation. The flood swept down the slope to the meadow lands and emptied into a water course known as the Burying Ground Brook, which leads to the cemetery at Upper Corner. Every farm bordering on the brook was injured. A number of small bridges were wrecked, a beautiful field with growing crop was destroyed by a landslide, a fine field of corn was covered with gravel and debris, and other standing crops were swept away. The damage was as follows:

Bridges and roads .....	\$400 00
Hay, oats, and other crops .....	2,000 00
Total .....	2,400 00

This estimate is based upon figures supplied by Messrs. G. H. Wallace, E. L. Price, and Frank Tufts, and if anything the loss is underestimated. The storm seemed to be confined to a narrow strip of land about 1 mile wide and 3 in length, stretching from McGinn settlement toward the Sussex cemetery. The greater part of the rain fell in ten minutes.

At Sussex there were thunder and the usual shower, but no indication that such a rainfall had occurred so close at hand.

Thunder was recorded in New Brunswick during 1897 on thirty-three days, divided among the months as follows:

March .....	1	September .....	3
May .....	3	October .....	0
June .....	8	November .....	2
July .....	7		
August .....	9	Total .....	33

<sup>1</sup>This text and the date in the above table appear to be slightly discrepant.—En.